16 March 2022

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Jon Degotardi
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Ref: MSEC1248 Revision A

Dear Jon,

RE: Metropolitan Mine – 2021 Annual Review Report
Subsidence Monitoring Results

1. Background

Metropolitan Coal submitted an Extraction Plan for Longwalls 305 to 307 on 9 October 2019. Approval for Longwalls 305 to 307 was granted on 16 March 2020.

A summary of the commencement and completion dates for the longwalls in the 300 series of longwall panels at Metropolitan Colliery is provided in Table 1.1.

Table 1.1 Longwall commencement and completion dates

Longwall	Commencement date	Completion date
LW301	20 June 2017	4 February 2018
LW302	29 March 2018	4 October 2018
LW303	13 November 2018	2 June 2019
LW304	28 July 2019	28 January 2020
LW305	14 April 2020	21 November 2020
LW306	15 June 2021	*Current (retreat chainage 526 m at 31 December 2021)*

Longwall extraction during the 2021 reporting period from 1 January to 31 December 2021 included Longwall 306 from commencement chainage 526 metres (m) (extracted void length 1381 m). Mine Subsidence Engineering Consultants (MSEC) has prepared this subsidence review report which will support the Annual Review for 2021. This report provides the review and discussion of the observed and predicted ground movements, impacts and performance measures for the extents mined during 2021.

The Longwall 305 to 307 Subsidence Monitoring Program (Version B) (Metropolitan Coal, 2020) was prepared to validate subsidence predictions and analyse the relationship between the subsidence effects and subsidence impacts of the Metropolitan Coal Longwall 305-307 Extraction Plan in accordance with Condition 6, Schedule 3 of the Project Approval.

The objectives of the monitoring program are:

- To monitor the subsidence parameters and subsidence impacts about Longwalls 305-307 extraction.
- To provide subsidence parameter and subsidence impact data required as part of the management of environmental consequences as detailed in the Metropolitan Coal Longwalls 305-307 Extraction Plan. These include:
    - Water Management Plan;
    - Biodiversity Management Plan;
    - Land Management Plan;
    - Heritage Management Plan;
    - Built Features Management Plans; and
    - Public Safety Management Plan.
- To validate subsidence predictions.
- To provide subsidence data to improve the predictive methods and provide a better understanding of the underlying factors contributing to ground movement.

The Metropolitan Coal Longwalls 305-307 Built Features Management Plans have been prepared to manage the potential environmental consequences of the Longwalls 305-307 Extraction Plan on built features.

2. Monitoring

The Metropolitan Coal Longwalls 305-307 Subsidence Monitoring Program include monitoring of subsidence parameters and comparison with predicted subsidence parameters. The results of subsidence parameter monitoring for Longwalls 305-307 from 1 January to 31 December 2021 are described below.

Subsidence monitoring data from the following monitoring components were assessed for the reporting period (i.e 1 January to 31 December 2021) in accordance with the Longwalls 305-307 Subsidence Monitoring Program:

- 300 XL Line;
- Princes Highway Line;
- M1 North Bound Line;
- Telecommunication Towers;
- Bridge 2 (Old Princes Highway Underpass);
- Cawley Road Overbridge;
- Eastern Tributary Cross Lines;
- Ridge Top and Reservoir Survey Stations; and
- Real Time Global Navigation Satellite System (GNSS) Units.

The following surveys were not conducted during the review period and are not included in this report.

- Transmission Towers;
- Optic Water Line;
- Waratah Rivulet Cross Lines; and
- Light Detection and Ranging (LiDAR) surveys.

The subsidence parameter monitoring locations for the Longwalls 305-307 Subsidence Monitoring Program are shown on Drawing No. MSEC1248-01 and are described below.

Subsidence movements are surveyed in three dimensions using a total station survey instrument. It can be seen from Drawing No. MSEC1248-01 that some monitoring lines are located outside the currently extracted longwall footprint for Longwalls 305-307. In such cases (i.e. away from the extracted longwall footprint), the observed subsidence movements are generally low and within the limits of survey accuracy. At low values of subsidence, observed results may also be affected to a greater extent by environmental factors such as moisture and temperature variation. The adopted limits of survey accuracy for three dimensional (3D) survey methods are of the order of ±20 millimetres (mm) for vertical subsidence, ±0.5 millimetres per metre (mm/m) for tilt (based on a 20 m bay length) and ±0.5 mm/m (based on a 20 m bay length) for tensile and compressive strains based on conventional movements. Low values of predicted subsidence also have a larger limit of accuracy of subsidence predictions as discussed in report No. MSEC285 Rev C (MSEC, 2008), which notes, "*where subsidence is predicted at points beyond the goaf edge, which are likely to experience low values of subsidence, the predictions should generally be accurate to within 50 mm of subsidence.*"

Several real time GNSS survey monitoring marks have been installed at selected locations to monitor subsidence movements from the extracted longwalls. The real time monitoring marks are referred to as GNSS stations and comprise a continuous GNSS based monitoring system. The system provides continuous 3D position data (i.e. easting, northing and height) to a precision of ±5 mm.

A brief description of each monitoring component included in the Longwall 305-307 Subsidence Monitoring Program is provided below.

300 XL Line

The 300 XL Line is the main monitoring line across and approximately perpendicular to Longwalls 301 to 306, extending from the M1 Princes Motorway to the Woronora Reservoir full supply level. Towards the completion of Longwall 305, the monitoring line was extended to the west across the Woronora Reservoir for future longwall extraction.

Princes Highway Line

The Princes Highway Line is located along the Old Princes Highway road shoulder and extends from the intersection with the M1 Princes Motorway in the south to the entrance to Garrawarra Centre Complex in the north.

Optic Water Line

The Optic Water Line extends from the Old Princes Highway to within the Garrawarra Centre Complex along the alignment of optical fibre cables and water supply pipelines.

M1 North Bound Line

The M1 North Bound Line extends from M1 Princes Motorway Bridge 2 to the Cawley Road Overbridge along the verge of the M1 Princes Motorway.

Transmission Towers

The Transmission Tower monitoring includes the TransGrid 330 kilovolts (kV) towers and Endeavour Energy 132 kV towers located to the east of the longwalls.

Telecommunications Towers

The telecommunications towers include three towers to the north and east of Longwall 303 and Longwall 304 respectively (one Telstra Monopole and two Axicom lattice towers), and one tower (Sydney Trains lattice tower) located above the chain pillar between the commencing ends of Longwalls 302 and 303.

Bridge 2 (Old Princes Highway Underpass)

Structural elements of the bridge are monitored using a combination of total station survey and fibre optic monitoring system.

Cawley Road Overbridge

Structural elements of the bridge are monitored using total station survey.

Eastern Tributary Cross Lines

Four cross lines established across the Eastern Tributary rock bars (ETAQ, ETAR, ETAT and ETAU) immediately upstream of the Woronora Reservoir full supply level.

Waratah Rivulet Cross Lines

Four cross lines established across the Waratah Rivulet rock bars (P, Q, R, S, T, U, V, and W) immediately upstream of the Woronora Reservoir full supply level.

Ridge Top and Reservoir Survey Stations

Ridge Top Survey Stations comprise seven ridge top trig stations set up on the ridges around the Woronora Reservoir.

GNSS Units

Real time monitoring using GNSS units has been adopted to supplement monitoring using conventional terrestrial survey methods at Metropolitan Colliery.

LiDAR Survey

LiDAR surveys provide remote sensing methods to supplement conventional terrestrial survey methods.

3. Comparison Between Predicted and Observed Movements

The period of monitoring during January to December 2021 included Longwall 306 from commencement chainage 526 m (extracted void length 1381 m). A discussion of the subsidence effects observed during this period of monitoring is provided in the following sections.

300 XL Line

The location of the 300 XL Line is shown in Drawing No. MSEC1248-01. A summary of the observed and predicted subsidence movements along the 300 XL Line for the latest survey is presented in Table 3.1. The latest survey for the 300 XL Line was conducted after the completion of Longwall 305.

Table 3.1 Summary of Predicted and Observed Subsidence Movements for the 300 XL Line

Monitoring Summary		
Initial Survey Date	17th June 2017	
Latest Survey Date	14th January 2021	
Longwall 305 Chainage at Latest Survey Date	120 m	
Parameter	**Total Movements (LW301 to 305)**	
	Predicted	**Observed**
Subsidence (mm)	1100	1317
Tilt (mm/m)	5.0	8.3
Tensile Strain (mm/m)	1.0*	0.9
Compressive Strain (mm/m)	2.0*	3.4

Note: * denotes that the maximum predicted tensile and compressive strains are based on conventional movements.

The maximum observed total subsidence, tilt and strain due to the extraction of Longwalls 301 to 305 are similar to or greater than the maximum predicted subsidence parameters. The greater than predicted subsidence at the northern end of the longwalls is believed to have been influenced by variation in extracted seam thickness due to operational and geotechnical reasons at the northern end of Longwall 301. Based on the survey monitoring lines,

and LiDAR surveys, the surface extent of the increased subsidence zone is limited to the area around the topographical high point above Longwalls 301 and 302. The increased subsidence is potentially also influenced by the local topographical features in this area. The natural or built features within the area of increased subsidence include the Sydney Water pipeline, Optus optical fibre cable, Waterfall cemetery, and two swamps (S41 and S53). Based on the relevant Metropolitan Coal Built Features Management Plan Trigger Action Response Plans (TARPs), the sections of Sydney Water pipeline and Optus optical fibre cable within the area of increased subsidence were at Level 3. With increasing distance to the current Longwall 306, these features are no longer monitored using this monitoring line.

Princes Highway Line

The location of the Princes Highway Line is shown in Drawing No. MSEC1248-01. A summary of the observed and predicted subsidence movements along the Princes Highway Line for the latest survey is presented in Table 3.2. A total of 25 surveys were undertaken during 2021.

Table 3.2 Summary of Predicted and Observed Subsidence Movements for the Princes Highway Line

Monitoring Summary		
Initial Survey Date	11th May 2017	
Latest Survey Date	14th December 2021	
Longwall 306 Chainage at Latest Survey Date	567 m	
Face Distance of LW306 from Princes Highway Line	240 m	
Parameter	**Total Movements (LW301 to 306)**	
	Predicted	**Observed**
Subsidence (mm)	1050	1073
Tilt (mm/m)	3.0	4.0
Tensile Strain (mm/m)	1.0*	1.3
Compressive Strain (mm/m)	1.0*	0.7

Note: * denotes that the maximum predicted tensile and compressive strains are based on conventional movements.

The maximum observed total subsidence of 1073 is slightly higher than the predicted value of 1050 mm. The maximum observed tilt of 3.8 mm/m is greater than the predicted tilt of 3.0 mm/m. An observed tilt of 5.1 mm/m was measured above Longwall 302 after the completion of Longwall 304. The maximum observed tensile strain is greater than predicted. The maximum observed tensile strain occurs in a single survey bay adjacent to the commencing end of Longwall 305. Elsewhere, strains are less than predicted and predominantly within the limits of survey accuracy. The maximum observed compressive strain is less than predicted. Based on the relevant Metropolitan Coal Built Features Management Plan TARPs the Princes Highway is at Level 3.

It is considered that the ground movements measured along the Princes Highway Line are generally consistent with the predictions.

M1 North Bound Line

The location of the M1 North Bound Line is shown in Drawing No. MSEC1248-01. A summary of the observed and predicted subsidence movements along the M1 North Bound Line for the latest survey is presented in Table 3.3. The latest survey for the M1 North Bound Line was conducted during the extraction of Longwall 306.

Table 3.3 Summary of Predicted and Observed Subsidence Movements for the M1 North Bound Line

Monitoring Summary		
Initial Survey Date	1st May 2017	
Latest Survey Date	29th October 2021	
Longwall 306 Chainage at Latest Survey Date	1002 m	
Distance of LW306 from M1 North Bound Line	1260 m	
Parameter	**Total Movements (LW301 to 306)**	
	Predicted	**Observed**
Subsidence (mm)	50	51
Tilt (mm/m)	< 0.5	0.3
Tensile Strain (mm/m)	< 0.5*	0.4
Compressive Strain (mm/m)	< 0.5*	0.3

Note: * denotes that the maximum predicted tensile and compressive strains are based on conventional movements.

The maximum observed subsidence, tilt and strain at the completion of Longwall 305 are less than or similar to predictions.

Based on the relevant Metropolitan Coal Built Features Management Plan TARP the Roads and Maritime Services (RMS) built features are at Level 1. It is considered that the ground movements measured along the M1 North Bound Line are consistent with the predictions.

Telecommunications Towers

The locations of the Telecommunications Towers are shown in Drawing No. MSEC1248-01. The mine subsidence movements of the Telecommunications Towers were measured using 3D monitoring and levelling techniques. Monitoring commenced on 29th March 2018, prior to the commencement of Longwall 302 extraction. During the reporting period, four towers were monitored with 23 surveys being completed.

A summary of the maximum observed total subsidence parameters at the Telecommunications Towers for the reporting period is presented in Table 3.4. The observed movements are based on the latest survey carried out on the 16th November 2021.

Table 3.4 Summary of Predicted and Observed Total Subsidence Movements for the Telecommunications Towers due to Longwalls 302 to 306

Monitoring Summary								
Initial Survey Date	29th March 2018							
Latest Survey Date	16th November 2021							
Longwall 306 Chainage at Latest Survey Date	835 m							
Face Distance of LW306 from nearest Telecommunications Tower	1055 m							
Parameter	**Sydney Trains**		**Telstra**		**Axicom (Vodafone)**		**Axicom (Optus)**	
	Predicted	**Observed**	**Predicted**	**Observed**	**Predicted**	**Observed**	**Predicted**	**Observed**
Subsidence (mm)	450	337	225	121	200	102	175	78
Tilt (mm/m)	3.5	3.8	2.0	1.8	1.5	1.0	1.5	0.8
Tensile Strain (mm/m)	0.5	0.8	0.5	0.4	0.5	0.4	0.5	0.5
Compressive Strain (mm/m)	0.5	0.1	0.5	0.0	0.5	0.1	0.5	0.0

Note: * denotes that the maximum predicted tensile and compressive strains are based on conventional movements.

The observed total subsidence at the Telecommunications Towers due to the extraction of Longwalls 302 to 306 is less than predicted. The observed total tilt at the Sydney Trains Telecommunications Tower is slightly higher than the predicted tilt. The observed total tilts at the remaining towers are less than predicted. Tensile strains are slightly higher than predicted at the Sydney Trains towers. Compressive strain is less than predicted at all towers.

Differential horizontal leg movements are measured for the lattice tower structures owned by Axicom. The maximum differential horizontal movement between the tower legs was 1 mm at 16th November 2021. The observed differential horizontal movement is less than the Level 1 TARP trigger value of 2.5 mm, which is based on a structural assessment undertaken by Cardno.

Differential horizontal and vertical leg movements are measured for the lattice tower structure owned by Sydney Trains. The maximum differential horizontal movement between the tower legs was 3 mm at 16th November 2021. The observed differential horizontal movement is less than the Level 1 TARP trigger value of 5.4 mm, which is based on a structural assessment undertaken by Cardno. Access to the compound has not been available during Longwall 306 to conduct high precision pin surveys of the tower legs. The ground prisms do not have sufficient accuracy for reporting differential vertical movement between the tower legs. The tower tilt based on the ground prisms showed a close relationship with the tilt based on the high precision pins and have therefore been used to calculated tower tilt. Based on the relevant Metropolitan Coal Built Features Management Plan TARPs the tilt of the Sydney Trains tower is at Level 2.

Bridge 2 (Old Princes Highway Underpass)

Bridge 2 is located approximately 300 m to the south east of Longwall 301 and is approximately 1160 m from the finishing end of Longwall 306. The location of Bridge 2 is shown in Drawing No. MSEC1248-01.

The mine subsidence movements at Bridge 2 were monitored using a fibre optic monitoring system to the end of June 2021, after which the system was decommissioned following review by the technical committee. The absolute 3D monitoring movement is supported by accurate real time monitoring by GNSS station (GNSS03) which is located 130 m to the north west of Bridge 2 and continued to operation following decommissioning of the fibre optic system.

GNSS03 had moved 43 mm in a north north-west direction at 31st December 2021, representing total horizontal movement since the commencement of Longwall 301. Total vertical subsidence at GNSS03 was 27 mm at 31st December 2021. The absolute horizontal movement is less than predicted horizontal movement in the order of 95 mm. The vertical subsidence at GNSS03 is slightly higher than the predicted vertical subsidence of less than 20 mm at the bridge. It is noted that GNSS03 is positioned closer to the extracted longwalls and predicted vertical subsidence at the location of GNSS03 is 60 mm.

An assessment of the bridge structure is undertaken regularly by Cardno as part of the ongoing assessment of RMS assets by the RMS technical committee. At the latest survey to the end of December 2021, the assessment by Cardno reported no issues with Bridge 2 relating to extraction of Longwalls 301 to 306.

Cawleys Road Overbridge

Cawleys Road Overbridge is located approximately 1.5 km to the northeast of Longwall 301. The location of the Cawleys Road Overbridge is shown in Drawing No. MSEC1248-01.

The mine subsidence movements at Cawleys Road Overbridge are monitored using absolute GNSS station (GNSS09) and relative movement of the structural elements of the bridge using 3D total station survey. GNSS09 is located 190 m to the west of Cawleys Road Overbridge.

GNSS09 had moved a horizontal distance of 10 mm at 31st December 2021, representing total horizontal movement due to extraction of Longwalls 301 to 306. Total vertical subsidence at GNSS09 was -12 mm (uplift) for the reporting period. The absolute horizontal and vertical movements are consistent with predicted movements of less than survey accuracy. No survey was undertaken of the bridge survey prisms during the reporting period.

An assessment of the bridge structure is undertaken regularly by Cardno as part of the ongoing assessment of RMS assets by the RMS technical committee. The most recent survey following the completion of Longwall 304, reported no issues with Cawleys Road Overbridge relating to extraction of Longwalls 301 to 304.

Eastern Tributary ETAU Rock Bar

The location of the Eastern Tributary ETAU Rock Bar lines are shown in Drawing No. MSEC1248-01.

Monitoring of Rock Bar ETAU was undertaken in accordance with an adaptive management process using a TARP to provide high accuracy monitoring data and assessment by a Technical Committee. Monitoring of ETAU during the review period included the following:

- Cross line ETAU with permanently installed prisms across the rock bar. The prisms are surveyed using conventional total station survey methods. Expected accuracy of closure measurement for these lines is ±3 mm.
- Three high resolution fixed lines, A Line, B Line and C Line, using prisms attached to sandstone across the base of the Eastern Tributary Valley near Pool ETAU. The lines are surveyed using a high precision total station. Expected accuracy for these lines is ±1 mm.
- Three real time GNSS monitoring stations providing real time closure monitoring around Pool ETAU. The expected accuracy of measurement between GNSS stations is ±10 mm.

A maximum total closure of 47 mm was observed across Rock Bar ETAU at 28th December 2021. Upsidence of 26 mm was also observed in the relative subsidence monitoring data.

Ridge Top and Reservoir Survey Stations

The locations of the Ridge Top and Reservoir Survey Stations are shown in Drawing No. MSEC1248-02. During the extraction of Longwalls 301 to 306, a series of GNSS units were installed adjacent to the Ridge Top Survey Stations and at other locations surrounding the Woronora Reservoir Catchment and these are used for current and future survey data at these locations.

A summary of the maximum total subsidence and closure between the Ridge Top and Reservoir Survey Stations during 2021 is presented in Table 3.5 and Table 3.6.

Table 3.5 Summary of Predicted and Observed Subsidence Movements for GNSS Stations Resulting from Longwalls 301 to 306

GNSS ID	Location		Dist. from LW306 void (m)	Predicted Total Subsidence due to LW301 to 306 (mm)	Observed Total Subsidence at 31 Dec 2021 (mm)	Initial Survey Date
39	Solid Coal	460m NE of LW23A	2300	< 20	13	05 Nov 2019 during LW304
40	Goaf	Above LW22B	2106	< 20	18	05 Nov 2019 during LW304
33	Solid Coal	640m NW of LW25	1338	< 20	7	16 Sep 2019 during LW304
24	Solid Coal	228m from LW27 610m from LW302	765	< 20	24	16 Jan 2019 during LW303
44	Solid Coal	230m from LW306	1090	< 20	2	10 Mar 2021 prior to LW306
43	Solid Coal	715m from LW306	713	< 20	4	10 Mar 2021 prior to LW306
03	Solid Coal	200m from LW301	1191	60	27	29 May 2017 at start of LW301
04	Solid Coal	50m from LW301	1104	100	54	29 May 2017 at start of LW301
21	Solid Coal	305m from LW302	588	40	43	16 Jan 2019 during LW303
22	Solid Coal	270m from LW302	602	85	40	16 Jan 2019 during LW303
23	Solid Coal	210m from LW302	627	70	36	16 Jan 2019 during LW303
30	Solid Coal	430m from LW304	291	120	31	02 Sep 2019 during LW304
31	Solid Coal	385m from LW304	306	100	30	02 Sep 2019 during LW304
14	Goaf	Above LW302 maingate pillar	646	925	878	05 Oct 2018 prior to LW303
27	Goaf	Above LW305 maingate pillar	29	425	307	02 Sep 2019 during LW304
26	Solid Coal	415m from LW305	207	< 20	57	22 Sep 2019 during LW304

GNSS ID	Location		Dist. from LW306 void (m)	Predicted Total Subsidence due to LW301 to 306 (mm)	Observed Total Subsidence at 31 Dec 2021 (mm)	Initial Survey Date
25	Solid Coal	794m from LW305	586	< 20	26	16 Jan 2019 during LW303
46	Solid Coal	70m from LW306	135	30	3	19 Jun 2021 during LW306
45	Solid Coal	135m from LW306	69	50	22	19 Jun 2021 during LW306
29	Solid Coal	515m from LW305	307	< 20	21	02 Sep 2019 during LW304
28	Solid Coal	426m from LW305	218	< 20	41	01 Sep 2019 during LW304
34	Solid Coal	895m from LW305	687	< 20	22	16 Sep 2019 during LW304
37	Solid Coal	427m from LW305	367	< 20	8	22 Sep 2019 during LW304
35	Solid Coal	2028m from LW305	1823	< 20	0	22 Sep 2019 during LW304
36	Solid Coal	803m from LW305	705	< 20	7	22 Sep 2019 during LW304

Table 3.6 Summary of Predicted and Observed Closure Movements for GNSS Stations Resulting from Longwalls 301 to 306

GNSS Stations	Distance from valley base to LW306 void	Extraction represented at latest survey date	Predicted Total Subsidence due to LW301 to 306 (mm)	Observed Total Subsidence at 31 Dec 2021 (mm)	Comments
Waratah Rivulet alignment					
Southern closure line 39 to 40	1888	From LW304 ch 495m	< 20	-6	
Waratah closure line upper 33 to 24	885	From LW304 ch 880m	< 20	9	
Waratah closure line lower 44 to 43	888	From LW306 ch 1907m	< 20	1	
300XL closure line upper 25 to 14	137	From LW303 ch 890m	150	352	GNSS 14 above extracted longwalls
300XL closure line lower 26 to 27	100	From LW304 ch 830m	200	273	GNSS 27 above extracted longwalls
Weir line 46 to 45	102	From LW306 ch 1885m	175	65	
Garrawarra line lower 29 to 28	267	From LW304 ch 960m	40	37	
Garrawarra line upper 34 to 37	457	From LW304 ch 830m	< 20	36	
Northern closure line 35 to 36	1305		< 20	2	
Eastern Tributary alignment					
Eastern closure line upper 1 24 to 03	778	From LW303 ch 890m	60	31	
Eastern closure line upper 2 24 to 04	716		70	42	
ETAU monitoring 21 to 22	569		80	46	
ETAU monitoring 21 to 23	620		80	35	
F27 lineament monitoring 30 to 31	296	From LW304 ch 960m	175	47	

It can be seen in Table 3.5 that the maximum observed total subsidence similar to or less than predicted subsidence at the majority of the GNSS locations. The observed subsidence is greater than predicted at six of the 25 GNSS locations. The greater than predicted subsidence occurs at low magnitudes of subsidence. As noted in Section 2, predicted subsidence beyond the goaf edge at low values of subsidence should generally be accurate to within 50 mm.

The observed closure in Table 3.6 is greater than predicted for GNSS sites 25 to 14, 26 to 27, and 34 to 37. GNSS sites 14 and 27 are located above the Longwall 301 to 306 goaf and significant horizontal movement of these marks is dominating the observed closures. The observed closure for GNSS 34 to 37 is low in magnitude and within expected limits of accuracy. Observed closures along the alignment of the Eastern Tributary are less than predicted.

4. Condition 3, Schedule 3 of the Project Approval

Condition 3, Schedule 3 of the Project Approval states:

If the subsidence effects and subsidence impacts of the project exceed the relevant predictions by more than 15% at any time after mining has progressed beyond the halfway mark of Longwall 21, or if the profile of vertical displacement does not reflect predictions, then the Proponent shall use appropriate numerical modelling to supplement the subsequent predictions of subsidence effects and subsidence impacts for the project to the satisfaction of the Director-General.

A comparison of the maximum observed and maximum predicted total conventional subsidence for the Project after each longwall for Longwalls 3 to 27 and Longwalls 301 to 306 is shown in Fig. 4.1. The comparison of conventional subsidence effects excludes the valley cross lines which represent non-conventional subsidence movements.

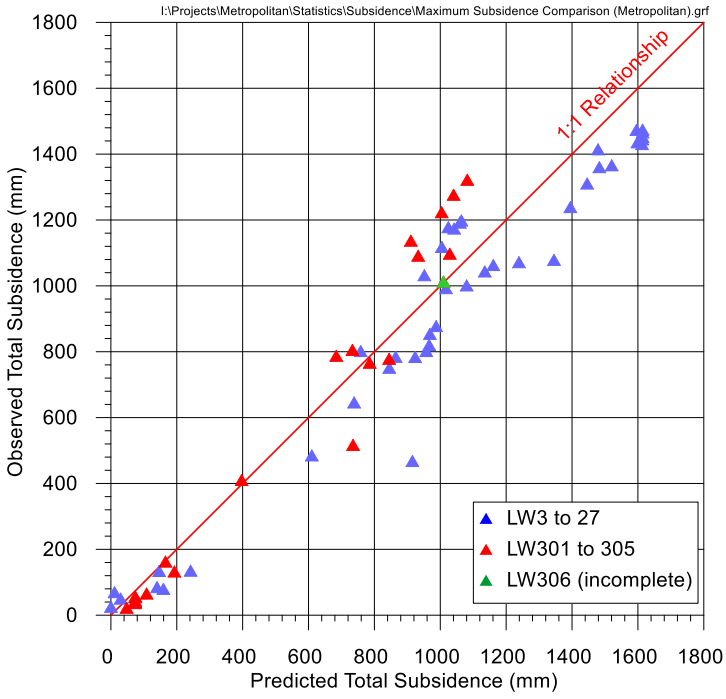

Fig. 4.1 Comparison between the maximum observed and maximum predicted total conventional subsidence for Longwalls 3 to 27 and Longwalls 301 to 306 at Metropolitan Colliery

A histogram of the maximum observed divided by the maximum predicted vertical subsidence is shown in Fig. 4.2.

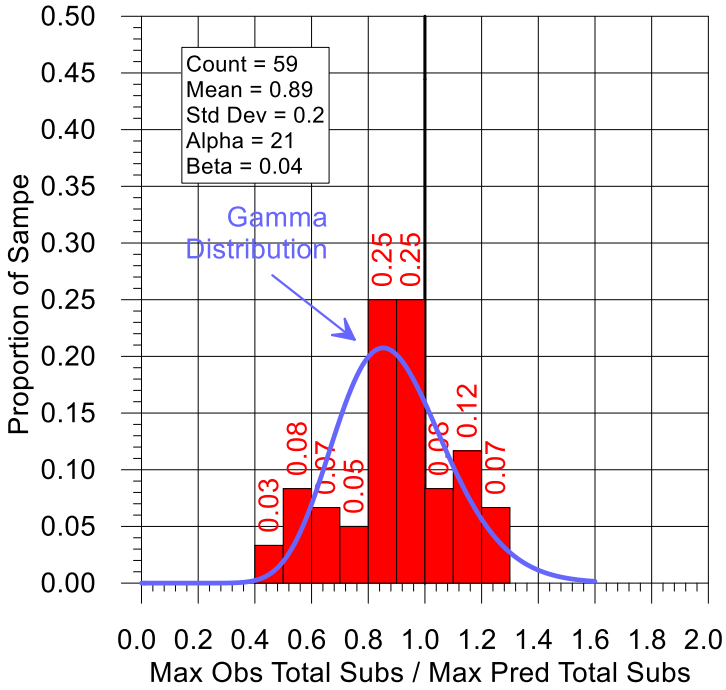

Fig. 4.2 Histogram of maximum observed/maximum predicted total vertical subsidence with gamma distribution

The mean of the maximum observed divided by the maximum predicted vertical subsidence for the project shown in Fig. 4.2 is 0.89, indicating that, on average, observed subsidence is 11% less than predicted for the project. Based on the results of survey data to date and comparison with predicted conventional subsidence parameters, the profiles of vertical displacement adequately reflect the predictions. The overall subsidence effects of the project do not exceed predictions by more than 15%.

5. Southern Sydney Sheltered Forest

In accordance with the Metropolitan Coal Biodiversity Management Plan Longwalls 305 to 307 (Version A), an assessment has been made for the subsidence effects at the occurrences of the Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion Endangered Ecological Community (EEC) situated over 900 m to the north east of Longwall 306. The assessment of subsidence effects included assessment of the Princes Highway Line and Telecommunications Towers, which are located between the EEC and the extracted longwalls. The subsidence monitoring results are discussed in Section 3.

The results of the assessment indicate that the subsidence parameters to the north east of Longwall and 306 were negligible and as predicted or less than those predicted for the reporting period. Assessment of subsidence parameters indicates subsidence effects at the occurrence of the Southern Sydney Sheltered Forest on Transitional Sandstone Soils EEC situated to the north east of Longwalls 306 are within typical magnitudes of survey accuracy and equate to a Level 1 significance level consistent with the Biodiversity Management Plan for Longwalls 305 to 307 (Version A).

6. Summary

The observed profile shapes and subsidence parameters are generally similar to those predicted or within limits of accuracy of the predicted subsidence parameters. The maximum observed total conventional subsidence along the 300 XL Line is greater than predicted. Based on previous LiDAR surveys, and the survey monitoring lines, the surface extent of the increased subsidence zone is limited to the area around the topographical high point above Longwalls 301 and 302. The increased subsidence is potentially influenced by the local topographical features in this area. The natural or built features within the area of increased subsidence include the Sydney Water pipeline, Optus optical fibre cable, Waterfall cemetery, and two swamps (S41 and S53). Based on the relevant Metropolitan Coal Built Features Management Plan TARPs the Sydney Water pipeline and Waterfall cemetery were at Level 2 and Optus optical fibre cable is at Level 3, however these features are no longer monitored. The greater than predicted subsidence at the northern end of the longwalls is believed to have also been influenced by variation in

extracted seam thickness due to operational and geotechnical reasons at the northern end of Longwall 301. The currently monitored Princes Highway is at TARP Level 3 based on the observed tensile strain, and the Sydney Trains telecommunications tower is at TARP Level 2 based on the observed tilt.

Based on the results of survey data to date and comparison with predicted conventional subsidence parameters, the profiles of vertical displacement adequately reflect the predictions. The overall subsidence effects of the Project do not exceed predictions by more than 15%.

Yours sincerely,

Peter DeBono
Mine Subsidence Engineering Consultants

Attachments:

Drawing No. MSEC1248-01 Rev. A - General Layout and Monitoring Lines

Drawing No. MSEC1248-02 Rev. A – Ridge Top and Reservoir Survey Stations

References:

MSEC 2008. MSEC285 Revision C (August 2008) – The Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts on Natural Features and Surface Infrastructure Resulting from the Proposed Extraction of Longwalls 20 to 44 at Metropolitan Colliery in support of a Part 3a Application.

Metropolitan Coal, 2020. Metropolitan Coal Longwalls 305-307 Subsidence Monitoring Program (Rev. SMP-R01-B, January 2020).

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HELENSBURGH COAL
METROPOLITAN COLLIERY
2021 ANNUAL REVIEW REPORT
GENERAL LAYOUT & MONITORING LINES

DATE:	SCALE:	DRAWING No:	Rev No
11 Mar 2022	1:12 500	MSEC1248-01	01

Grid to MGA co-ordinates

313 000
312 000
6 218 000
6 217 000
6 216 000
6 215 000

LAKE WORONORA
Garrawarra
EEC06
330kV Transmission Line
132kV Transmission Line
M1 PRINCES MOTORWAY
FIRE RD 9E
FIRE RD 9G
TRACK

GNSS 09
F9132B-T5
Tower 110
F9132B-T6
Tower 109
F9132B-T7
Tower 108
F9132B-T8
Tower 107
F9132B-T9
300 XL Line
Tower 106
F9132B-T10
Tower 105
GNSS 05
F9132B-T11
GNSS 04
Tower 104
F9132B-T12
GNSS 03
Princes Motorway Bridge 2
Tower 103
F9132B-T13

VC4
GNSS 36
GNSS 37
VC3
GNSS 34
VC1
GNSS 28
GNSS 29
GNSS 45
GNSS 46
GNSS 25
GNSS 26
GNSS 27
300 XL Line
GNSS 50
GNSS 51
GNSS 14
GNSS 30
GNSS 31
GNSS 42
GNSS 22
GNSS 23
GNSS 32
GNSS 21
GNSS 43
GNSS 24
ETAU
ETAT
ETAR
ETAQ
ET Lines

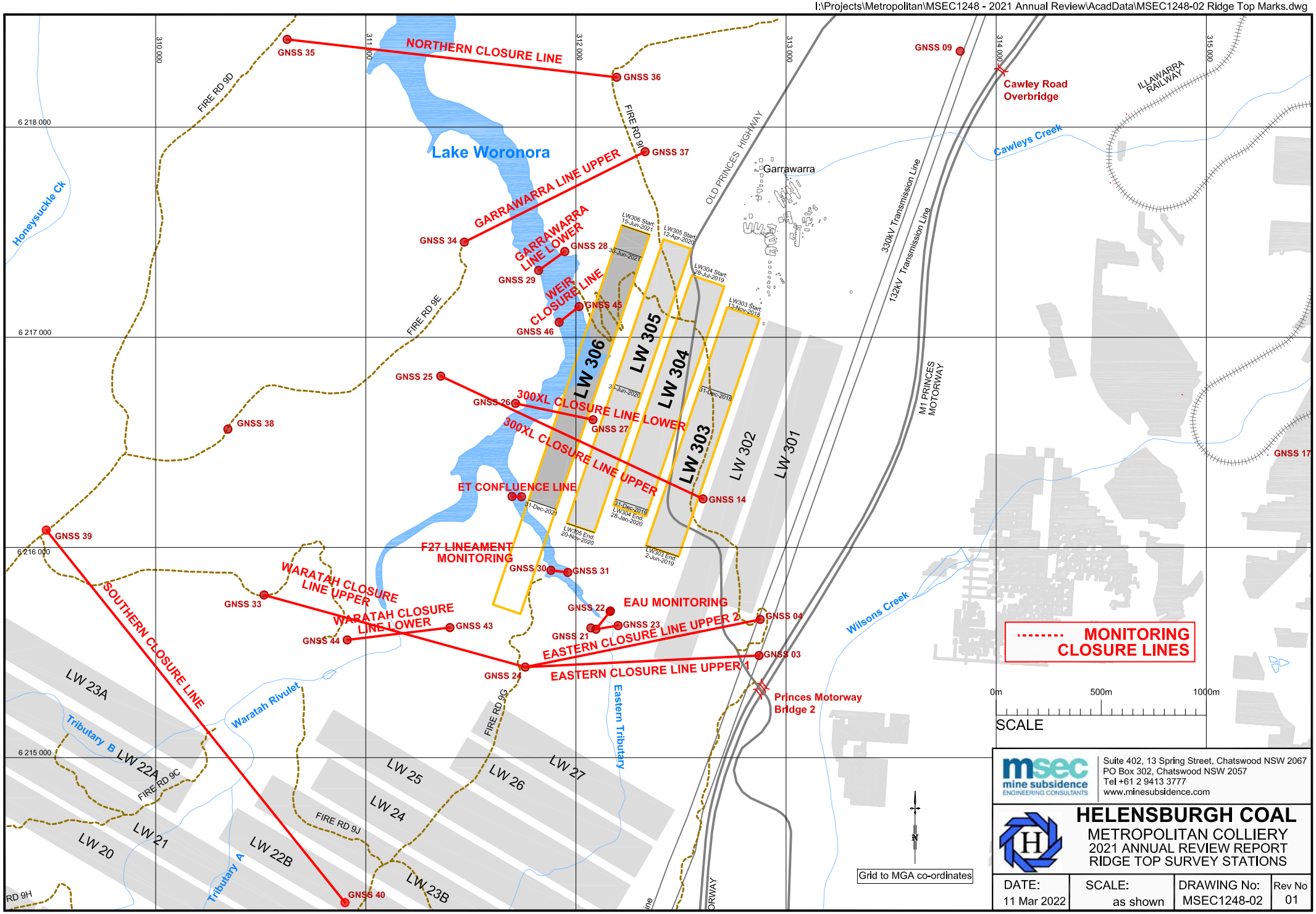
LW306 Start: 15-Jun-2021
LW305 Start: 12-Apr-2020
LW304 Start: 28-Jul-2019
LW303 Start: 13-Nov-2018
30-Jun-2021
30-Jun-2020
31-Dec-2018
31-Dec-2021
31-Dec-2019
LW304 End: 28-Jan-2020
LW305 End: 20-Nov-2020
LW303 End: 2-Jun-2019

LW 306
LW 305
LW 304
LW 303
LW 302
LW 301
LW 27
LW 26
LW 25
Princes Highway Line
Optic Water Line

Site 1 (AXICOM OPTUS)
Site 2 (AXICOM VODAFONE)
Site 3 (TELSTRA)
Site 4 (SYDNEY TRAINS)

LEGEND
MONITORING LW304 and 305-307 SUBSIDENCE MONITORING PROGRAM
ENDANGERED ECOLOGICAL COMMUNITIES (EEC)

I:\Projects\Metropolitan\MSEC1248 - 2021 Annual Review\AcadData\MSEC1248-02 Ridge Top Marks.dwg



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HELENSBURGH COAL

METROPOLITAN COLLIERY
2021 ANNUAL REVIEW REPORT
RIDGE TOP SURVEY STATIONS

DATE:	SCALE:	DRAWING No:	Rev No
11 Mar 2022	as shown	MSEC1248-02	01